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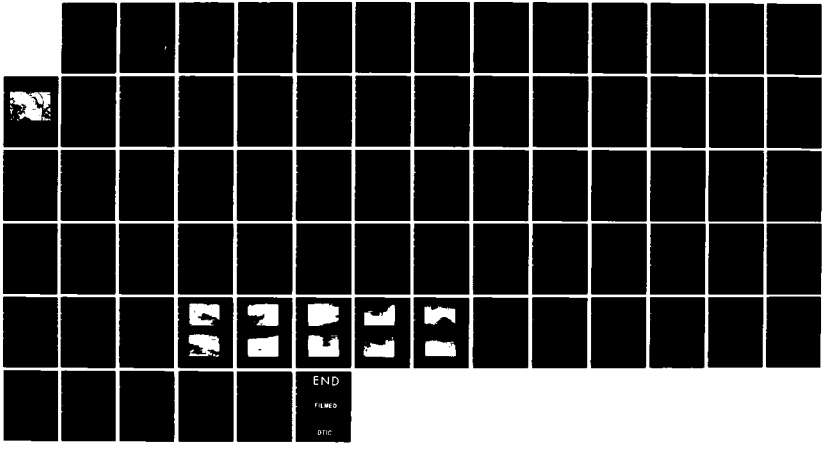

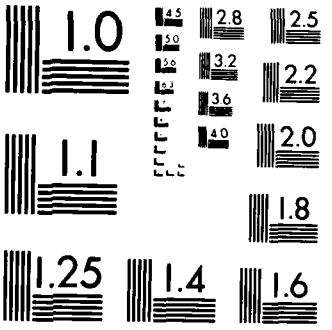

CONNECTICUT RIVER BASIN
NORTHUMBERLAND, NEW HAMPSHIRE

CONNECTICUT GROVETON DAM
N.H. 00147

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS. 02154

FEBRUARY 1979

UNCLASSIFIED

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Northumberland New Hampshire
Connecticut River

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The dam is a run of the river, log crib and stone dam, 180 ft. long and about 24 ft. high. The dam is intermediate in size with a low hazard potential. The drainage area for the dam is 1194 square miles with a mormal impoundment o f 235 acres. The dam is in poor condition and subject to failure during major storm flow conditions.

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DEPARTMENT OF THE ARMY
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424 TRAPELO ROAD
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REPLY TO
ATTENTION OF

NEDED

Honorable Hugh J. Gallen
Governor of the State of New Hampshire
State House
Concord, New Hampshire 03301

Dear Governor Gallen:

I am forwarding to you a copy of the Connecticut Groveton Ian Phase I Inspection Report, which was prepared under the National Program for Inspection of Non-Federal Dams. This report is presented for your use and is based upon a visual inspection, a review of the past performance and a brief hydrological study of the dam. A brief assessment is included at the beginning of the report. I have approved the report and support the findings and recommendations described in Section 7 and ask that you keep me informed of the actions taken to implement them. This follow-up action is a vitally important part of this program.

A copy of this report has been forwarded to the Water Resources Board, the cooperating agency for the State of New Hampshire. In addition, a copy of the report has also been furnished the owner, Mr. Michael LaPua, Plant Engineer, Groveton Paper Company, Groveton, New Hampshire 03582.

Copies of this report will be made available to the public, upon request, by this office under the Freedom of Information Act. In the case of this report the release date will be thirty days from the date of this letter.

I wish to take this opportunity to thank you and the Water Resources Board for your cooperation in carrying out this program.

Sincerely yours,

John [illegible]
Colonel, Corps of Engineers
Division Engineer

CONNECTICUT GROVETON DAM

NH 00147

NORTHUMBERLAND, NEW HAMPSHIRE

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

NATIONAL DAM INSPECTION PROGRAM
PHASE I INSPECTION REPORT

Identification No:	NH00147
Name of Dam:	Connecticut Groveton Dam
Town:	Northumberland
County and State:	Coos, New Hampshire
Stream:	Connecticut River
Date of Inspection:	November 16, 1978

BRIEF ASSESSMENT

The Connecticut Groveton Dam is a run-of-the-river, log crib and stone dam, 180 feet long and approximately 24 feet high, with concrete abutments. The power houses at each abutment have been deactivated some twenty years ago. The head gates are open, but partially plugged with debris. A bypass channel around the Vermont side power house shows signs of extensive deterioration and past erosion. The dam is judged to be in poor condition.

The dam is classified as intermediate size with a low hazard potential in the event of a dam failure; therefore, the 100-year flood is used as the test flood. Due to the relatively small storage, the test flood inflow equals the test flood outflow of 41,500 CFS. The spillway and bypass channel have a maximum combined capacity of 33,100 CFS without overtopping the concrete abutment. This capacity is 79.8 percent of the test flood. Although the abutments would be overtopped by 2.2 feet by the test flood, the flood would be contained within the riverbanks with a maximum capacity of 48,728 CFS. The drainage area for the dam is 1194 square miles with a normal impoundment of 235 acres.

The following significant conditions were observed:

1. The log crib spillway is in poor condition with a major portion of the apron section having been washed out in recent years. Without the apron sections, the water is falling nearly vertically to the base of the dam causing major undermining of the remaining portions of the dam.

2. The remaining approach sections show signs of significant horizontal and vertical movement.

3. The bypass spillway and channel have undergone extensive deterioration. A small rise in river flow causes water to flow through the bypass. The original log crib embankment protection has washed away and there are indications of significant past erosion.

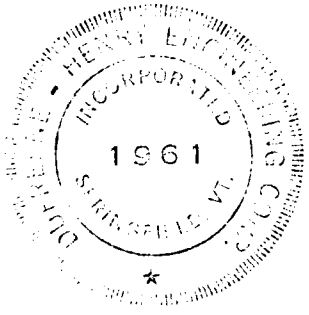
The Connecticut Groveton Dam is in poor condition and subject to failure during major storm flow conditions. A detailed assessment and recommendations for remedial measures are contained in Section 7 of this report. In summary, it is recommended that a qualified consultant engineer be engaged to investigate and design the following so that remedial measures can be instituted within one year of the receipt of this report:

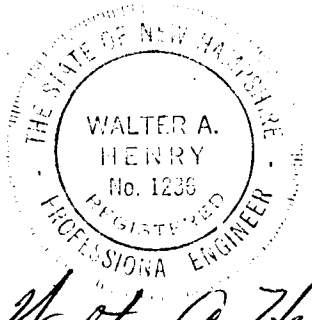
1. Evaluate the stability of the remaining sections of the dam and if found stable, design and construct repairs to the apron and damaged approach sections of the dam.

2. If the existing portions of the dam are not stable, design and construct a completely new dam.

3. Design and reconstruct the bypass spillway and bypass channel embankment protection.

Subsequent to the repairs listed above, institute a program of annual periodic inspection of the spillway and bypass channel, replacing any wood members that have deteriorated.





Walter A. Henry

This Phase I Inspection Report on Connecticut Groveton Dam has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgment and practice, and is hereby submitted for approval.

Joseph W. Finegan

JOSEPH W. FINEGAN, JR., MEMBER
Water Control Branch
Engineering Division

Joseph A. McElroy

JOSEPH A. MCELROY, MEMBER
Foundation & Materials Branch
Engineering Division

Carney M. Terzian

CARNEY M. TERZIAN, CHAIRMAN
Chief, Structural Section
Design Branch
Engineering Division

APPROVAL RECOMMENDED:

Joe B. Fryar

JOE B. FRYAR
Chief, Engineering Division

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing and detailed computational evaluations are beyond the scope of a Phase I Investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test Flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

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c. Appurtenant Structures

The dam was originally used for hydroelectric power generation. Power houses were constructed on both sides of the dam. The concrete foundations of the power houses and intake facilities also serve as the abutments for the log crib dam. Both power houses have been inoperative for approximately 15-20 years.

The left side power house (New Hampshire side, see Photo 4) is in good to fair condition. The original concrete block building is still intact and is currently being utilized for storage. The concrete foundation is in fair to poor condition with considerable spalling occurring to exposed surfaces (see Photo 5). The intake facilities include a covered intake channel with trash racks and five 8-foot wide gates. All of the gate lifting mechanisms have been removed and the gates are open and secured with steel cables. The interior of the power house was not accessible during the inspection.

The right side power house (Vermont side, see Photos 1 and 6) is in fair to poor condition. All of the original construction has been removed to the concrete foundations, including all mechanical equipment. The three intake gates are open and secured with steel cables. Judging from the volume of water leaving the three bays, it appears that two of the three gates are partially or totally blocked with debris.

Significant cracking of the concrete foundation is occurring on the downstream wall (see Photo 6).

At first glance it appears that an embankment to the right of the Vermont power house has been breached. An eroded channel, varying in width from 10 to 30 feet, exists between the old power house and the right river embankment (see Photos 7, 8 and 9, and the site plan). A review of data on file with the New Hampshire Water Resources Board indicates that the channel was originally a spillway channel with a log crib weir and slope protection for the abutment. The cribbing along the embankment is completely washed out and only remnants of the spillway weir still remain. The resultant effect on the abutment is the same as if a breach had occurred. A small rise in the river level between one and two feet causes water to flow through the overflow channel. The existing bed and banks of the upstream portions of the channel are natural stone rubble and appear to be stable for flows ranging from two to three feet in depth. Flows in excess of three feet would contact earth portions of the embankment and might result in considerable erosion (see Photo 8).

SECTION 3 - VISUAL INSPECTION

3.1 Findings

a. General

The on-site inspection of the Connecticut Groveton Dam was performed on November 16, 1978. Water was flowing over the overflow section of the dam at the time of inspection, preventing a detailed visual observation. Although the dam was found in poor condition, there were no emergency conditions noted during the inspection.

b. Dam

A detailed inspection of the dam was impossible because of the amount of water flowing over the log crib dam. However, it was possible to observe that the dam is in an obviously poor condition. Approximately 100 feet of apron in the midsection of the dam and a small section near the right abutment are completely missing. The stone fill from the cribbing can be seen approximately 50 feet downstream, but there were no signs of the cribbing (see Photos 1, 2 and 3).

Without the apron sections the water flowing over the dam is falling nearly vertically to the streambed where the apron used to be. The water current patterns downstream of the crest (see Photo 1) indicate that a significant amount of undermining has already occurred due to the vertical water flow.

The crest and approach sections are also showing signs of deterioration. The original crest was protected by a steel plate section running the entire length of the dam. The steel plate is still intact near the abutments but appears to be missing from the midsection. Logs can be seen below the crest, protruding at various angles (see Photos 1 and 3) indicating that some settlement or displacement has occurred.

The approach section of the dam which is partially visible is covered with wood planking, providing a smooth flow transition upstream of the crest. Irregular water currents occur approximately 15 feet upstream of the crest at the midsection of the dam (see Photo 3). These irregular currents indicate that the smooth surface of the approach has been altered by settlement and/or horizontal displacement.

It is reasonable to assume that the loss of the apron sections and undermining of the crest will lead to the progressive failure of the remaining sections of the dam.

c. Validity

Not applicable.

SECTION 2 - ENGINEERING DATA

2.1 Design

A timber or log crib dam is made of wood members bolted into cribs and filled with rock. This type of dam usually leaks considerably and its resistance against sliding is reduced by buoyant forces which decrease the effective weight of the dam. A relatively long sloping approach apron is also utilized to increase the resistance to sliding and reduce leakage. The life span of a timber crib dam varies between 10 and 40 years depending upon climatic conditions, amount of maintenance performed and type of timber used. Cedar, redwood and cypress are the most durable timbers.

All design and original construction data for this dam have either been destroyed or cannot be located by the Groveton Papers Company.

2.2 Construction

According to the records, this dam was constructed between 1910 and 1920. The log crib structure was built on an earth foundation and tied into concrete abutments. An emergency bypass channel was constructed around the Vermont side power house, with a log crib spillway weir and slope protection placed against the abutment. The site plan found in Appendix B was drawn from visual observations and data obtained from the New Hampshire Water Resources Board and approximately represents the dam as it now exists.

2.3 Operation

The dam is not being operated at the present time.

2.4 Evaluation

a. Availability

Design and construction records for this dam are not available.

b. Adequacy

The lack of in-depth engineering data does not allow for a definitive review. Therefore, the adequacy of this dam, structurally and hydraulically, cannot be assessed from a review of design calculations but must be based primarily on visual inspection and sound engineering judgment.

(5) Upstream Channel

Connecticut River, approximate width - 250 feet.

(6) Downstream Channel

Connecticut River, approximate width - 200 feet.

j. Regulating Outlets

The regulating head gates at both power houses are inoperative. All gates are in the open position and secured with steel cables and all mechanical lifting mechanisms have been removed. From the amount of water observed leaving the tailraces, the gates appear to be partially blocked with debris. Gate inverts and depths could not be obtained because of the water flowing through them.

New Hampshire side - 5 gates, 8 feet wide.
Vermont side - 3 gates, 8 feet wide.
(All gates are open and secured with steel cables.)

(3) Height

24 feet.

(4) Top Width

Not applicable.

(5) Side Slopes

Could not measure.

(6) Zoning

None known.

(7) Impervious Core

Not applicable.

(8) Cutoff

Not applicable.

(9) Grout Curtain

Not applicable.

h. Diversion and Regulating Tunnel

Not applicable.

i. Spillway

(1) Type

Log crib - triangular section.

(2) Length

180 feet.

(3) Crest Elevation

87.2

(4) Gates

None.

d. Reservoir

(1) Length of Maximum Pool

Not applicable - run-of-the-river dam.

(2) Length of Recreation Pool

Not applicable - run-of-the-river dam.

(3) Length of Flood Control Pool

Not applicable - run-of-the-river dam.

e. Storage

(1) Recreation Pool

550 acre-feet (estimated by New Hampshire Water Resources Board).

(2) Maximum Pool

Not applicable - run-of-the-river dam.

f. Reservoir Surface

(1) Recreation Pool

235 acres (estimated by New Hampshire Water Resources Board).

(2) Maximum Pool

Not applicable - run-of-the-river dam.

(3) Top of Dam

Not applicable - run-of-the-river dam.

g. Dam

(1) Type

Log crib, stone with concrete abutments, run-of-the-river dam.

(2) Length

180 feet.

(4) Test Flood

The combined spillway bypass channel capacity of 33,100 CFS, at elevation 100.0, is 79.8 percent of the test flood of 41,500 CFS. The test flood would result in a water surface elevation of 102.2 which is 2.2 feet above the left abutment, but 1.8 feet below the approximate top of the river banks at elevation 104.0.

c. Elevations

(Based on an assumed elevation of 100.0 at the top of the concrete platform of the New Hampshire power house. See plan sheet for TBM location.)

(1) Top of Dam

Left abutment - 100.0
Right abutment - 100.9
River banks - 104±

(2) Maximum Pool

104±

(3) Full Flood Control Pool

104±

(4) Recreation Pool

87.2

(5) Spillway Crest

87.2

(6) Upstream Portal Invert

Not applicable.

(7) Streambed at Centerline of Dam

76.2

(8) Maximum Tailwater

Not known.

(9) Test Flood Surcharge

102.2

The recent inspection of November 16, 1978 found the dam to be in the same apparent configuration as in 1975. The reader is referred to Section 3 for a detailed description of that inspection.

i. Normal Operating Procedures

There are no operating procedures evident or reported for this dam.

1.3 Pertinent Data

a. Drainage Area

The drainage area above the Connecticut Groveton Dam consists of 1194 square miles in New Hampshire, Vermont and Canada. The relatively large area includes a wide range of terrain and the soils are predominantly glacial till with shallow hardpan or bedrock.

b. Discharge at Dam Site

(1) Spillway

The log crib spillway is 180 feet long with a maximum capacity of 29,700 CFS with the water elevation at the top of the left abutment (elevation 100.0). The gates at both abutments are open but because of the possibility of clogging they were not used to calculate hydraulic capacity.

(2) Bypass Spillway and Channel

The 30-foot wide bypass channel in the right abutment has undergone extensive deterioration and erosion. A relatively small rise in river elevation causes water to flow over the remains of the spillway weir and into the bypass channel. The capacity of the bypass spillway and channel has been estimated at 3,400 CFS with the water surface at the top of the left abutment (elevation 100.0).

(3) Maximum Known Flood at Dam Site

According to the records at the Dalton, New Hampshire gauge, located approximately 22 miles downstream, the maximum known flood occurred on March 20, 1936 of 48,600 CFS. Using the hydrologic ratio between Dalton and Groveton, the resultant flood at Groveton is estimated at 40,800 CFS.

g. Purpose

The original purpose of the Connecticut Groveton Dam was power generation for the Groveton Papers Company. The two power houses were deactivated approximately 20 years ago. The Vermont side power house was dismantled down to its foundation and all mechanical equipment removed. The New Hampshire power house was partially dismantled. A concrete block building is currently used for storage and one of the original turbine wheels is reported to be still in place.

In its present condition the dam is serving no useful purpose with the possible exception of aesthetics associated with the impoundment pool.

h. Design and Construction History

There are no design or construction data available for the original dam, which dates back to 1910-20. The first correspondence on file with the New Hampshire Water Resources Board is an inspection report dated August 19, 1936. This inspection found the dam to be in fair condition. Subsequent inspections performed in 1939 and 1951 also found the dam to be in fair condition.

The power houses were deactivated in the mid-1950s. The next State inspection which took place in October 1972 noted signs of deterioration in the crib overflow section. Sheathing boards were reported missing in each of the four overflow sections. The pictures accompanying the 1972 inspection show that there were 18-inch flashboards.

On July 1, 1973 the New England area experienced a major storm of 25-50-year return frequency. It is believed that this storm caused extensive damage to the Connecticut Groveton Dam. Pictures dated March 19, 1974 show that the flashboards and at least one apron section had washed away.

In September of 1975 some residents of Guildhall, Vermont expressed concern over the deteriorating condition of the dam. Their main concern was that sediment from the upstream paper mills would become exposed if the dam should fail. Letters from this group to the Water Resources Board prompted another inspection on September 23, 1975. This inspection found the dam had deteriorated rapidly since the 1972 inspection. At least three of the four apron sections had washed out leaving the river bed exposed to undermining.

power houses have been inactive for approximately 20 years and most of the mechanical equipment has been removed. Gates at both intake channels are open and water is flowing through the old structures.

An emergency spillway channel exists to the right of the Vermont side power house. The original log crib spillway and embankment protection, shown in the 1936 inspection sketch (see Appendix B) have washed away and a rise in river flow of one or two feet above the crest of the overflow section causes flow through this channel.

The log crib overflow section is in poor condition. Several sections of the apron have washed out and there are signs that remaining sections of the structure are rapidly deteriorating.

c. Size Classification

The Connecticut Groveton Dam is approximately 24 feet high and has an estimated storage potential of 1700 acre-feet. In accordance with the guidelines, dams with maximum storage between 1,000 and 50,000 acre-feet and/or maximum height between 40 and 100 feet are sized as intermediate. Since the Connecticut Groveton Dam storage exceeds 1,000 acre-feet, but is less than 50,000, the size classification is intermediate.

d. Hazard Classification

A failure of the Connecticut Groveton Dam would route the resulting flood waters into the downstream channel of the Connecticut River. The river channel is wide and well defined and any flood wave produced would be confined to the channel without any overbank flow. The hazard category is therefore low.

e. Ownership

The present owner of the Connecticut Groveton Dam is:

Groveton Papers Company
Groveton, New Hampshire 03582

f. Operator

The operation of the dam is under the supervision of:

Mr. Michael LeDuc, Plant Engineer
Groveton Papers Company
Groveton, New Hampshire 03582

Telephone: 603-636-1154

NATIONAL DAM INSPECTION PROGRAM
PHASE I INSPECTION REPORT
NAME OF DAM: CONNECTICUT GROVETON

SECTION 1 - PROJECT INFORMATION

1.1 General

a. Authority

Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a National Program of Dam Inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. Dufresne-Henry Engineering Corporation has been retained by the New England Division to inspect and report on selected dams in the State of New Hampshire. Authorization and notice to proceed were issued to Dufresne-Henry Engineering Corporation under a letter of November 20, 1978 from Max B. Scheider, Colonel, Corps of Engineers. Contract No. DACW33-79-C-0010 has been assigned by the Corps of Engineers for this work.

b. Purpose

(1) Perform technical inspection and evaluation of non-federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by nonfederal interests.

(2) Encourage and prepare the states to initiate quickly effective dam safety programs for nonfederal dams.

(3) To update, verify and complete the National Inventory of Dams.

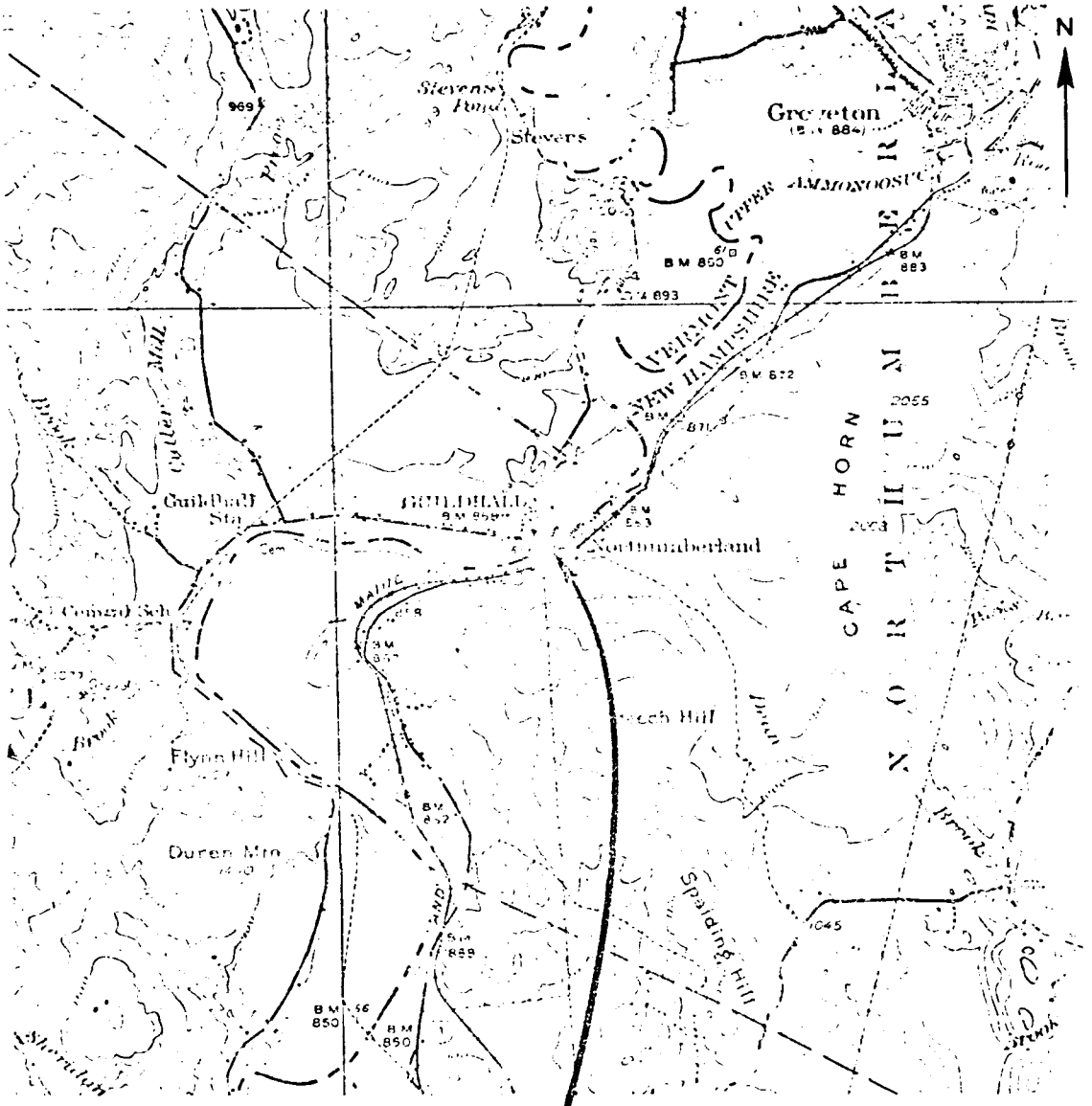
1.2 Description of Project

a. Location

The Connecticut Groveton Dam is located in northern New Hampshire on the Connecticut River, in the Town of Northumberland. The Town of Guildhall, Vermont is adjacent to the dam on the Vermont side of the River.

b. Description of Dam and Appurtenances

The overall length of the dam is 350 feet with a 180-foot long log crib and stone spillway. [illegible] power houses located at both ends of the overflow section serve as concrete abutments. The



SOURCE:
U.S.G.S. QUADRANGLE
GUILDHALL, VT.-N.H.
1:62,500 1956

LOCATION MAP
CONNECTICUT GROVETON DAM

GROVETON NEW HAMPSHIRE
CLIENT NO. 04-0312 1" = 1 MILE

OVERVIEW OF
CONNECTICUT GROVETON DAM
NORTHUMBERLAND, NEW HAMPSHIRE

The present overflow channel enters the river approximately 180 feet downstream. A large amount of sand has been deposited at this intersection due to reduced flow velocities. An older channel had extended much further downstream than the existing channel before entering the river. The river banks along this older channel show signs of significant past erosion. In particular, a section of a barn has fallen into the channel at some time in the past. It can be assumed that the barn collapse was due to the erosion of the foundation. At this point in time, it cannot be determined whether the erosion was caused by flow in the overflow channel or high flood flows in the river. The remaining portion of this barn can be seen in the upper left hand corner of Photo 3.

d. Reservoir Area

The impoundment area includes a highway bridge approximately 300 feet upstream of the dam (see Photo 10). The steel truss structure was built in 1919 as a replacement of an earlier bridge. It has been reported by an area resident that the existing center pier is part of the original bridge and was not reconstructed in 1919. The stone pier is reported to be resting on a spread timber footing. Depending on the footing's size, depth and condition, it may be subject to erosion should the dam fail.

In addition to the possible damage to the highway bridge, area residents are concerned about the quantity and quality of sediment which has been deposited in the impoundment pool due to the number of paper mills located upstream of the dam. These deposits may include some environmentally harmful compounds which, if released by erosion or exposed to the atmosphere, may cause some ecologically harmful effects.

e. Downstream Channel

The downstream channel consists of the natural channel of the Connecticut River. The banks are of various materials including stone rubble, earth and sand bank. Vegetation is well established and there are no signs of recent erosion except along the overflow channel located on the right bank.

3.2 Evaluation

From a visual inspection it is obvious that this dam is in an advanced stage of deterioration. Of particular concern are the almost complete failure of the downstream apron of the crib wall overflow section and the erosion of the right abutment. A

combination of severe conditions of major flood and/or ice movement could cause a failure of the crib wall section at any time. Without the steel plate and smooth planking protection on the approach section of the crest, the log cribbing will be exposed to floating ice which may dislodge remaining cribbing and cause total failure.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 Procedures

None.

4.2 Maintenance of Dam

None evident.

4.3 Maintenance of Operating Facilities

None evident.

4.4 Description of Warning System in Effect

None exists for this dam.

4.5 Evaluation

The deterioration of the dam structure has gone beyond the point where routine maintenance would be of any value. Major remedial action would be required to prevent further deterioration and complete failure.

SECTION 5 - HYDRAULIC AND HYDROLOGIC EVALUATION

5.1 Evaluation of Features

a. General

The Connecticut Groveton Dam is a run-of-the-river dam with a relatively small storage volume. The log crib structure is experiencing advanced deterioration due to age and the lack of maintenance.

b. Design Data

There is no known design data for the Connecticut Groveton Dam. Some hydraulic and hydrologic data can be found in the various inspection reports and file data of the New Hampshire Water Resources Board.

c. Experience Data

It is assumed that the deterioration of this dam began with the deactivation of the power plants some twenty years ago. Inspection reports completed by the New Hampshire Water Resources Board have documented the deterioration of the dam. These reports and accompanying photographs indicate that the last major storm in July 1973 caused considerable damage to the dam. A photograph taken by a local resident shows that the dam was nearly completely backwatered during that storm.

d. Visual Observations

The spillway is in poor condition with most of the apron washed away. The resultant undermining is causing additional deterioration to the remaining portions of the dam.

The original bypass channel included a log crib bypass spillway and log crib embankment protection. The original bypass spillway has been reduced to the point where only a small increase in river elevation will result in flow through the bypass channel.

Although all the old power house head gates are open, the flow through them is severely restricted by the amount of debris which has built up at the gate openings and the trash racks. Because the debris is not removed by a routine maintenance program, the gates cannot be considered effective in a determination of the dam's total hydraulic capacity.

e. Test Flood Analysis

The dam is classified to be intermediate size with a low hazard rating. Since the hazard category is low, a test flood of 100-year exceedance interval has been selected as a criterion for this study.

Record flow data was analyzed for USGS Gauge 01131500 located at Dalton, New Hampshire, approximately 22 miles downstream of Groveton. The flow data was processed by computer in accordance with the "United States Water Resources Council Guidelines" (Bulletin 17). The results of the Dalton analysis were adjusted (reduced) to suit conditions at Groveton by the ratio of their drainage areas to the three quarters power. This resulted in a 100-year test flood at Groveton of 41,500 CFS.

The combined spillway and bypass channel capacity of 33,100 CFS at elevation 100.0 is 79.8 percent of the test flood which is 41,500 CFS. The test flood would result in a water surface elevation of 102.2 which is 2.2 feet above the left abutment but 1.8 feet below the top of the river banks at elevation 104.0.

f. Dam Failure Analysis

If the Connecticut Groveton Dam were to fail under low flow or moderate flood conditions, a flood wave between 0 and 11 feet high would be released to the lower river channel. The actual height of the flood wave would depend on the height of backwater caused by the higher river flows.

A dam failure under normal flow conditions would produce a flood flow of approximately 6130 CFS. Considering a river capacity in the range of 48,000 CFS, the flood flow would be insignificant.

Since the dam is nearly completely backwatered during major storm flows any dam break would not result in any significant flow increase.

SECTION 6 - STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observation

Based on visual observations, the Connecticut Groveton Dam is in an advanced stage of deterioration. Major portions of the dam have already failed and washed downstream. In particular, approximately 100 feet of the dam apron has washed out, leaving the foundation material exposed to undermining from the water flowing over the dam. Water currents downstream of the dam indicate that a significant amount of undermining has probably already occurred. The crest and approach sections of the dam are also showing signs of deterioration. Logs can be seen in the overflow wash, protruding at nonuniform angles, indicating that displacement of the log cribbing is occurring. This is further supported by water current ripples in the water surface observed in an area approximately 15 feet upstream of the crest. These ripples and rising currents indicate that something has disturbed the smooth, planked approach section. It can reasonably be assumed that the loss of the gravity support of the apron sections and resultant undermining have contributed to significant displacement of the approach sections of the dam.

b. Design and Construction Data

There are no design or construction drawings available for the Connecticut Groveton Dam.

c. Operating Records

There are no operating records available for the Connecticut Groveton Dam. It has been reported by the Groveton Papers Company that all data concerning the dam have either been misfiled or destroyed.

d. Post-Construction Changes

Due to the lack of any operating records for the dam, any indication of post-construction changes must be obtained from intermittent State inspection reports. These inspections, performed in 1936, 1951, 1972 and 1975 do not indicate any significant structural changes to the dam, other than the gradual deterioration noted in Section 1.2.g.

e. Seismic Stability

The dam is in Seismic Zone 2 and in accordance with the recommended Phase I guidelines does not warrant seismic analysis.

SECTION 7 - ASSESSMENT, RECOMMENDATIONS/ REMEDIAL MEASURES

7.1 Dam Assessment

a. Condition

Based on the visual inspection, the Connecticut Groveton Dam is in poor condition and subject to failure at any time. The dam requires extensive remedial action and possibly complete reconstruction to return the structure to a stable condition.

b. Adequacy of Information

The lack of in-depth engineering data does not allow for a definitive review. Therefore the adequacy of this evaluation, structurally and hydraulically, cannot be assessed from the standpoint of review of design calculations, but must be based primarily on the visual inspection, past performance history and sound hydrologic and hydraulic engineering judgment. In this case the dam is in such poor condition that the visual observations and evaluations are adequate to justify the conclusions and recommendations.

c. Urgency

The recommendations given in Section 7.2 should be carried out within one year after receipt of this report.

d. Need for Additional Investigation

The additional investigations described in Section 7.2 should be carried out.

7.2 Recommendations

It is recommended that the following actions be taken under the guidance of an engineer, qualified in the design and construction of log crib dams:

1. Evaluate the structural stability of the remaining portions of the dam and if found to be stable, design and construct repairs to the existing dam.

2. If the existing portions of the dam are unstable, design and construct a completely new dam.

3. Design and construct embankment protection for the emergency overflow channel around the right side power house foundation.

4. Investigate the center pier footing of the highway bridge upstream of the dam and evaluate any possible resultant effects of a dam failure.

5. Clear the bypass channel of fallen trees and debris.

6. Evaluate the composition of the reservoir sediment for any possible harmful compounds. The analysis should include an assessment of any negative ecological effects which might result from erosion of sediment during a dam failure or if the alternative of removal of the dam is undertaken.

7.3 Remedial Measures

a. Operation and Maintenance Procedures

Subsequent to the repairs listed above, a program of annual periodic technical inspections of the spillway and emergency channel should be instituted, replacing any wood members that have deteriorated.

7.4 Alternatives

An alternative to the above recommendations is the removal of the dam subject to the findings of items 4 and 6 of the recommendations.

APPENDIX A

VISUAL INSPECTION CHECK LIST

VISUAL INSPECTION CHECK LIST
PARTY ORGANIZATION

PROJECT CONNECTICUT GROVETON DAM

DATE November 16, 1978

TIME 2:00 - 4:00 PM

WEATHER Partly cloudy, cool

W.S. ELEV._____U.S.____DN.S.

PARTY:

1. Jim Maynes D-H
2. Jim Dohrman D-H
3. Sherward Farnsworth D-H
4. Gonzalo Castro GEI
5. Ken Stern, New Hampshire Water Resources Board
6. _____
7. _____
8. _____
9. _____
10. _____

PROJECT FEATURE	INSPECTED BY	REMARKS
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		

PERIODIC INSPECTION CHECK LIST

PROJECT CONNECTICUT GROVETON DAM DATE November 16, 1978

PROJECT FEATURE _____ NAME _____

DISCIPLINE _____ NAME _____

AREA EVALUATED	CONDITION
DAM EMBANKMENT - LOG CRIB	*Water was flowing over dam spillway.
Crest Elevation	
Current Pool Elevation	
Maximum Impoundment to Date	
Surface Cracks	Crib dam is in very poor condition. The entire apron sections of the dam have failed and washed downstream at the center and right side. The crest is still intact but is slowly eroding and washing out. Flow at center is undermining remaining portions of dam.
Pavement Condition	
Movement or Settlement of Crest	
Lateral Movement	
Vertical Alignment	
Horizontal Alignment	
Condition at Abutment and at Concrete Structures	Very poor (apron washed out) at right power house. Good at left power house.
Indications of Movement of Structural Items on Slopes	N/A
Trespassing on Slopes	N/A
Sloughing or Erosion of Slopes or Abutments	N/A
Rock Slope Protection - Riprap Failures	N/A
Unusual Movement or Cracking at or Near Toes	N/A
Unusual Embankment or Downstream Seepage	Not observable - water flowing over dam.
Piping or Boils	None observed.
Foundation Drainage Features	None known.
Toe Drains	N/A
Instrumentation System	None known.

PERIODIC INSPECTION CHECK LIST

PROJECT CONNECTICUT GROVETON DAM DATE November 16, 1978

PROJECT FEATURE _____ NAME _____

DISCIPLINE _____ NAME _____

AREA EVALUATED	CONDITION
OUTLET WORKS - CONTROL BUILDING*	*Abandoned power houses on both sides of dam.
a. Concrete and Structural	
General Condition	Fair to poor - major cracking and spalli on right side building foundations.
Condition of Joints	Fair to poor.
Spalling	Minor.
Visible Reinforcing	None observed.
Rusting or Staining of Concrete	None observed.
Any Seepage or Efflorescence	None observed.
Joint Alignment	Fair to poor.
Unusual Seepage or Leaks in Gate Chamber	All gates (both sides) are open. Gate chambers were under water.
Cracks	Major cracking on right power house.
Rusting or Corrosion of Steel	None exposed to view.
b. Mechanical and Electrical	
Air Vents	None.
Float Wells	None observed.
Crane Hoist	None.
Elevator	None observed (no access to building).
Hydraulic System	None observed.
Service Gates	All gates are being held open with cables, all lifting mechanisms have been removed.
Emergency Gates	
Lightning Protection System	None observed.
Emergency Power System	None observed.
Wiring and Lighting System in Gate Chamber	

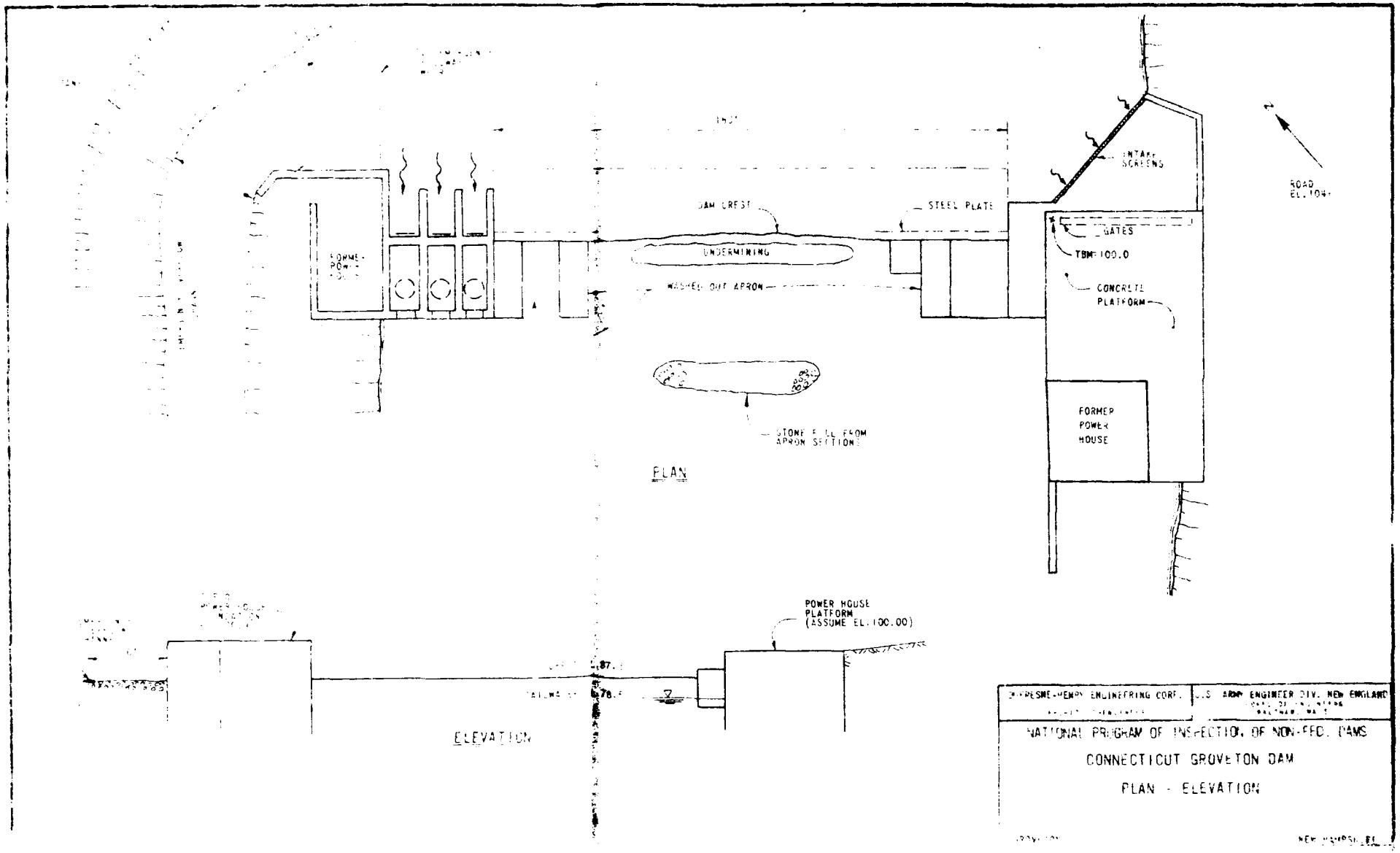
PERIODIC INSPECTION CHECK LIST

PROJECT CONNECTICUT GROVETON DAM DATE November 16, 1978

PROJECT FEATURE _____ NAME _____

DISCIPLINE _____ NAME _____

AREA EVALUATED	CONDITION
OUTLET WORKS - TRANSITION AND CONDUIT	N/A
General Condition of Concrete	
Rust or Staining on Concrete	
Spalling	
Erosion or Cavitation	
Cracking	
Alignment of Monoliths	
Alignment of Joints	
Numbering of Monoliths	


DAM CREST
STEEL PLATE
UNDERMINING
WASHED OUT APRON
STONE FILL FROM APRON SECTIONS
INTAKE SCREENS
GATES
TBM 100.0
CONCRETE PLATFORM
FORMER POWER HOUSE
ROAD EL. 104+
PLAN
POWER HOUSE PLATFORM (ASSUME EL. 100.00)
ELEVATION
NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS
CONNECTICUT GROVETON DAM
PLAN - ELEVATION

N. H. WATER RESOURCES BOARD
Concord, N. H. 03301

DAM SAFETY INSPECTION REPORT FORM

Town: Northumberland Dam Number: 132.01

Inspected by: S Burritt Date: 23 Sep 1975

Local name of dam or water body: _____

Owner: Groveton Papers Co Address: Groveton, N.H.

Owner ~~was~~/was not interviewed during inspection.

Drainage Area: 1029 sq. mi. Stream: Conn R

Pond Area: 235 Acre, Storage 1000± Ac-Ft. Max. Head 13± Ft.

Foundation: Type Earth, Seepage present at toe - Yes/No, _____

Spillway: Type Log Crib Plank Spill Freeboard over perm. crest: 12' 8"

Width 180', Flashboard height 0

Max. Capacity 30510 Taken from RBC Report 1972 c.f.s.

Embankment: Type _____, Cover _____ Width _____

Upstream slope _____ to 1; Downstream slope _____ to 1

Abutments: Type Concrete, Condition: Good, (Fair), Poor Some Surf. erosion

Gates or Pond Drain: Size _____ Capacity _____ Type _____

Lifting apparatus _____ Operational condition No

Changes since construction or last inspection: Not used for Power
VT Side Power Equip Removed NH side still in

Downstream development: Farm land, No houses until Rt 2 bridge

This dam ~~would~~/would not be a menace if it failed.

Suggested reinspection date: 1977

Remarks: Plank deck on spillway & apron are missi
in ~~some~~ Some Areas, High Water marks around VT
All gates appear to be inoperative Stones in conte
crib appear to be washing Down Stream

TELEPHONE
207-799-3603

55 HIGHLAND P...
SOUTH PORTL...
MAINE 04106

ROBERT B. FOLLANSBEE
Consulting Engineer
MARINE TERMINALS AND PIPELINES

September 18, 1975

Mr. Donald M. Rapoza, Water Resources Engineer
Water Resources Board
37 Pleasant St.
Concord, N. H. 03301

Dear Mr. Rapoza:

I just returned from an extended trip and found your letter of Sept. 12th.

The dam which I referred to is located on the Connecticut River (entirely within New Hampshire) and is at Northumberland. It is an ancient structure about 300' long with a head of about 12'. As I inlicated in my previous letter it is apparently unattended and is no longer used.

A short time ago the water in the river was so unusually low that the entire structure was more than normally visible. At that time I saw that a section of the apron about 75 to 100 ft. long was missing from the mid section of the dam. Also the supporting crib work beneath the apron was gone too leading to the conclusion that the main structure will likely fail, possibly during next spring's run-off.

The highway bridge about 300' upstream from the dam was replaced in 1919 but the center pier was not rebuilt. I am reasonably positive that this stone masonry pier rests on a spread timber footer which is not too deep. I recall being able to see this footer years ago but it is now silted over. Thus the danger of footer, pier and bridge failing should the dam breach with resulting upstream errosion.

Of course a failure of the dam would result in the usual down stream flood destruction but in this case there would most likely be a lasting ecological effect. For many years now there has been a gradual silting in of waste material from the Groveton Papers Company (about six miles upstream on the Upper Ammonosuc River). For about two or three weeks each summer during very low water the stench from these exposed deposits is terrible. Should the dam fail much of the deposited material would be spread on the agricultural meadows below and much would stay in place permanently exposed. Many miles of this beautiful valley would then become almost unlivable for a long period of time.

I would be very glad to visit this structure with you and could do so on September 25 or 26. I suggest that you phone me at the above listed number on the 22nd or 23rd and we can discuss the matter further.

Very truly yours,

Robert B. Follansbee

N. H. WATER RESOURCES BOARD
Concord, N. H. 03301

DAM SAFETY INSPECTION REPORT FORM

Town: Northumberland Dam Number: 182.01

Inspected by: Robert B. Chamberlin Date: Oct. 27 1972

Local name of dam or water body: _____

Owner: Groveton Paper Co. Address: Groveton, N.H.

Owner was/was not interviewed during inspection.

Drainage Area: 1028 sq. mi. Stream: Connecticut River

Pond Area: 235 Acre, Storage 700± Ac-Ft. Max. Head 28 Ft.

Foundation: Type _____, Seepage present at toe - Yes/No, _____

Spillway: Type Log crib, sheathed, Freeboard over perm. crest: 12.67

Width 180', Flashboard height 18",

Max. Capacity 30510 c.f.s.

Embankment: Type _____, Cover _____ Width _____,

Upstream slope _____ to 1; Downstream slope _____ to 1

Abutments: Type Concrete, Condition: Good, Fair, Poor

Gates or Pond Drain: Size _____ Capacity _____ Type _____

Lifting apparatus _____ Operational condition Not oper

Changes since construction or last inspection: Power house on Vt. side removed to foundations; power house on N.H. side has a generator but of 5 gates. 3 are permanently inoperative by cutting pinion shaft, other two are shut.

Downstream development: _____

This dam would/would not be a menace if it failed.

Suggested reinspection date: _____

Remarks: Each spillway has some sheathing board missing. All cribbing and protection of channel around Vt. power house is gone. One foot vise in river cases flow around dam. This dam and appurtenances are in very poor condition.

NEW HAMPSHIRE WATER CONTROL COMMISSION

DATA ON WATER POWER DEVELOPMENTS IN NEW HAMPSHIRE

LOCATION AT DAM NO. 182.01

Town Northumberland : County Coos

Stream Connecticut River

Basin-Primary Connecticut River : Secondary Connecticut River

Local Name

GENERAL DATA

Head-Max. ft.: Min. ft.: Ave. 11' ft.

Date of Construction : Use of Power Industrial

Pondage ac. ft.: Storage ac. ft.

DESCRIPTION

Racks

Size of Rack Opening

Size of Bar : Material

Area: Gross Sq. Ft.: Net sq. ft.

Head Gates

Type

Number : Size ft. high x ft. wide

Elevation of Invert : Total Area sq. ft.

Hoist

Penstock

Number : Material

Size : Length

Turbines

Number 4 : Makers 1-2 Morgan Smith vertical 3-Leffel

Rating HP. per unit 1,1250 - 3,000 : Total Capacity 6750 HP.

Max. Dement C.F.S., per unit : Total cfs.

Drive

Type

Generator

Number 2 IGE AC 700 KW

Make 1-400 KW 480 v 481 A Westinghouse

Rating KW., per unit ; Total Capacity K. W.

Exciter

Number : Make

Rating-per unit : Total Capacity K. W.

OUTPUT—KWHRS

19.....	:	19.....	
19.....	:	19.....	
19.....	:	19.....	
19.....	:	19.....	
19.....	:	19.....	

OWNER Wyoming Valley Paper Co. B-4

NEW HAMPSHIRE WATER CONTROL COMMISSION
DATA ON DAMS IN NEW HAMPSHIRE

LOCATION STATE NO. 182.01

Town Northumberland: County Coos

Stream Connecticut

Basin-Primary Connecticut: Secondary Connecticut

Local Name

Coordinates—Lat. 44°35' - 9300: Long. 71°35' - 7800

GENERAL DATA

Drainage area: Controlled Sq. Mi.: Uncontrolled Sq. Mi.: Total 1028 Sq. Mi.

Overall length of dam 350 ft.: Date of Construction

Height: Stream bed to highest elev. 25 ± ft.: Max. Structure 12'4" ft.

Cost—Dam : Reservoir

DESCRIPTION Crib timber and concrete Foundation earth

Waste Gates

Type

Number : Size ft. high x ft. wide

Elevation Invert : Total Area sq. ft.

Hoist

Waste Gates Conduit

Number : Materials

Size ft.: Length ft.: Area sq. ft.

Embankment

Type

Height—Max. ft.: Min. ft.

Top—Width : Elev. ft.

Slopes—Upstream on: Downstream on

Length—Right of Spillway : Left of Spillway

Spillway

Materials of Construction

Length—Total 180 ft.: Net ft.

Height of permanent section—Max. 12'4" ft.: Min. ft.

Flashboards—Type 18" Automatic : Height ft.

Elevation—Permanent Crest : Top of Flashboard

Flood Capacity 30610 cfs.: 25.3 cfs/sq. mi.

Abutments

Materials:

Freeboard: Max. 12'2" ft.: Min. ft.

Headworks to Power Devel.—(See "Data on Power Development")

OWNER Wyoming Valley Paper Co.

REMARKS Concrete Fill

Co. .....

No. 12

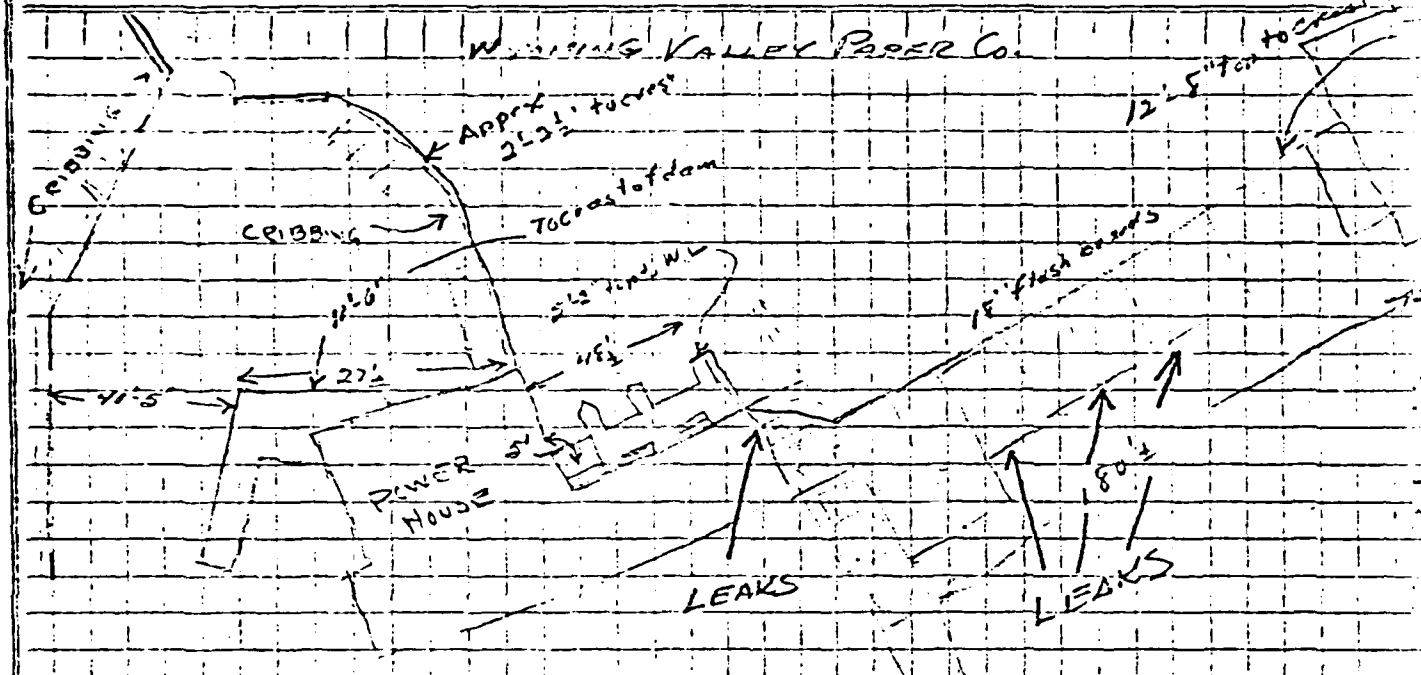
CALCULATION SHEET

Date Aug. 10, 1936

Refers to .....

Made By .....

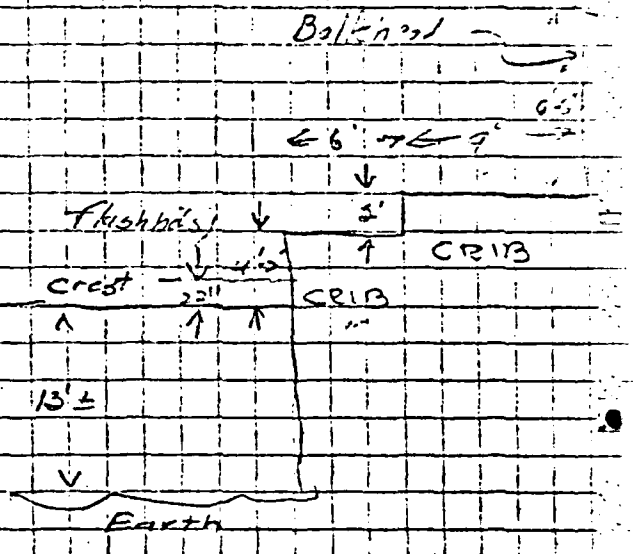
3648



3-Photos

1-Upstream

2-



MAY 1126

8-

NEW HAMPSHIRE WATER RESOURCES BOARD

INVENTORY OF DAMS AND WATER POWER DEVELOPMENTS

DAM

BASIN Connecticut NO. 1 — E-5425

RIVER Connecticut MILES FROM MOUTH 313.65 D.A.SQ.MI. 1028. 1120

TOWN Northumberland OWNER Wyman Valley Paper Co.

LOCAL NAME OF DAM

BUILT DESCRIPTION Cribb — Timber & Concrete on Earth

POND AREA-ACRES DRAWDOWN FT. POND CAPACITY-ACRE FT.

HEIGHT-TOP TO BED OF STREAM-FT. 25± MAX. MIN.

OVERALL LENGTH OF DAM-FT. 300± MAX.FLOOD HEIGHT ABOVE CREST-FT.

PERMANENT CREST ELEV.U.S.G.S. LOCAL GAGE

TAILWATER ELEV.U.S.G.S. LOCAL GAGE

SPILLWAY LENGTHS-FT. 160 FREEBOARD-FT. 12.0±

FLASHBOARDS-TYPE, HEIGHT ABOVE CREST 1.5' Automatic

WASTE GATES-NO.	WIDTH	MAX. OPENING	DEPTH SILL BELOW CREST

REMARKS Conditions Poor

3C

POWER DEVELOPMENT

UNITS	NO.	RATED HP	HEAD FEET	C.F.S. FULL GATE	KW	MAKE
	1	1650	11			Morgan Smith Vertical
	4	600				Leffel
	1				700	G.E. A.C. generator
	1				400	Westinghouse A.C. "
		1400	11 average		1100 est.	

USE Power

REMARKS

DATE 7/10/36

APPENDIX B

PROJECT RECORDS AND PLANS

A. Listing of Design, Construction and Maintenance Records

None.

B. Copies of Past Inspection Reports

1. "Inspection by Public Service Commission of New Hampshire August 10, 1936," with sketch.

2. "Inspection by New Hampshire Water Resources Board October 27, 1972."

3. "Letter from Robert B. Follansbee, Local Resident, Reporting Condition of Dam Sept. 18, 1975."

4. "Inspection by New Hampshire Water Resources Board September 23, 1975."

C. Listing of Plans

Figure 1 - Connecticut Groveton Dam

Plan - Elevation

PERIODIC INSPECTION CHECK LIST

PROJECT CONNECTICUT GROVETON DAM DATE November 16, 1978

PROJECT FEATURE _____ NAME _____

DISCIPLINE _____ NAME _____

AREA EVALUATED	CONDITION
RESERVOIR	
Stability of Shoreline	Bypass cribbing is gone. Erosion around right power house.
Sedimentation	Reported to contain mill waste.
Changes in Watershed Runoff Potential	None known.
Upstream Hazards	Bridge upstream is reported to have a spread timber footing at the center support.
Downstream Hazards	None.
Alert Facilities	None known.
Hydrometeorological Gages	None known.
Operational and Maintenance Regulations	None known.

PERIODIC INSPECTION CHECK LIST

PROJECT CONNECTICUT GROVETON DAM DATE November 16, 1978

PROJECT FEATURE _____ NAME _____

DISCIPLINE _____ NAME _____

AREA EVALUATED	CONDITION
OUTLET WORKS - SERVICE BRIDGE	N/A
a. Super Structure	
Bearings	
Anchor Bolts	
Bridge Seat	
Longitudinal Members	
Under Side of Deck	
Secondary Bracing	
Deck	
Drainage System	
Railings	
Expansion Joints	
Paint	
b. Abutment and Piers	
General Condition of Concrete	
Alignment of Abutment	
Approach to Bridge	
Condition of Seat and Backwall	

PERIODIC INSPECTION CHECK LIST

PROJECT CONNECTICUT GROVETON DAM DATE November 16, 1978

PROJECT FEATURE _____ NAME _____

DISCIPLINE _____ NAME _____

AREA EVALUATED	CONDITION
OUTLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE	N/A
a. Approach Channel	
Slope Conditions	
Bottom Conditions	
Rock Slides or Falls	
Log Boom	
Debris	
Condition of Concrete Lining	
Drains or Weep Holes	
b. Intake Structure	
Condition of Concrete	
Stop Logs and Slots	

PERIODIC INSPECTION CHECK LIST

PROJECT CONNECTICUT GROVETON DAM DATE November 16, 1978

PROJECT FEATURE _____ NAME _____

DISCIPLINE _____ NAME _____

AREA EVALUATED	CONDITION
OUTLET WORKS - BYPASS CHANNEL AROUND RIGHT POWER HOUSE	
a. Approach Channel	
General Condition	Timber crib bypass spillway - poor condition.
Loose Rock Overhanging Channel	None.
Trees Overhanging Channel	None.
Floor of Approach Channel	None.
b. Weir and Training Walls	N/A
General Condition of Concrete	
Rust or Staining	
Spalling	
Any Visible Reinforcing	
Any Seepage or Efflorescence	
Drain Holes	
c. Discharge Channel	
General Condition	Poor - crib embankment protection has been washed away.
Loose Rock Overhanging Channel	None.
Trees Overhanging Channel	Yes.
Floor of Channel	Natural stone - extensive erosion.
Other Obstructions	None.

PERIODIC INSPECTION CHECK LIST

PROJECT CONNECTICUT GROVETON DAM DATE November 16, 1978

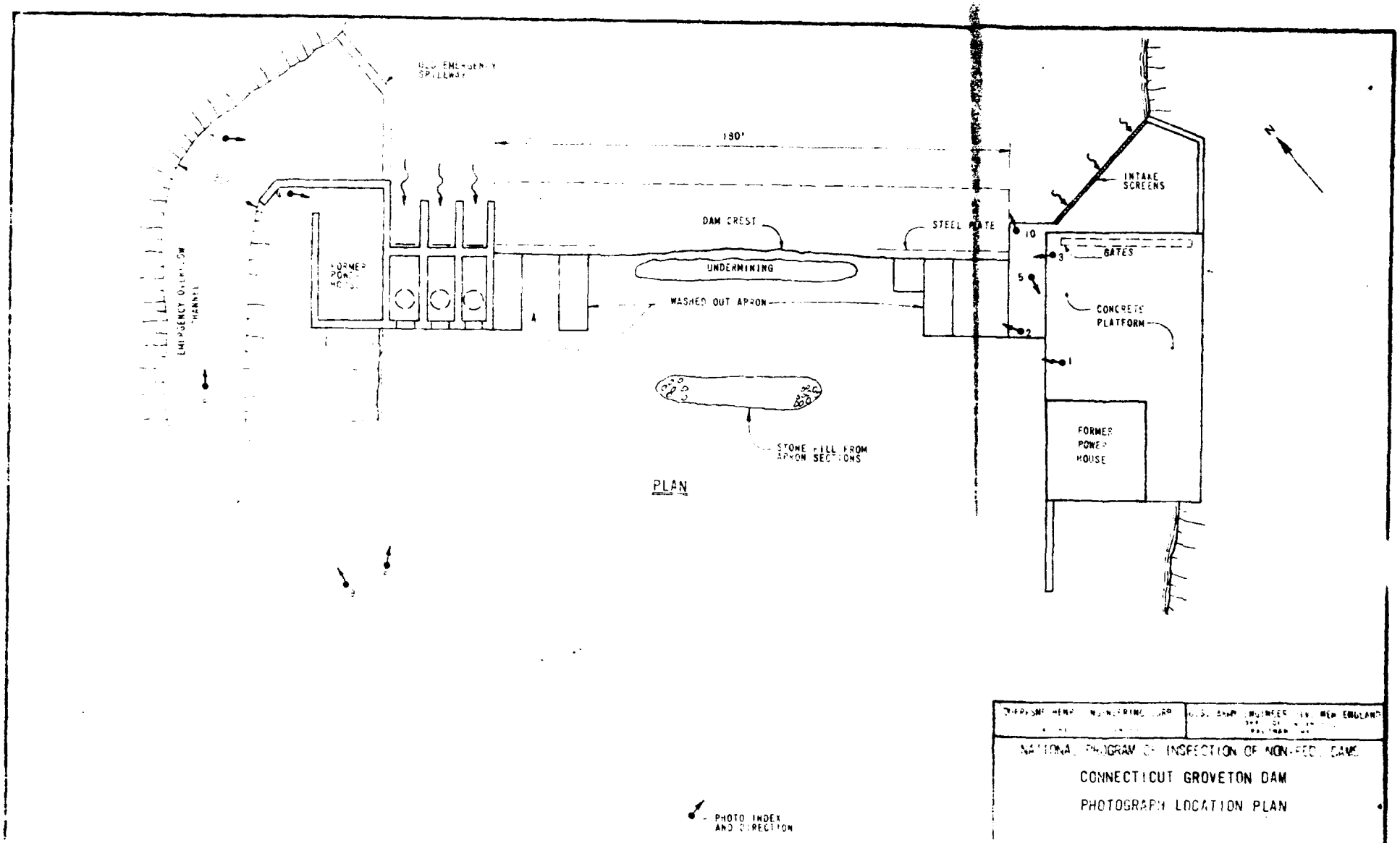
PROJECT FEATURE _____ NAME _____

DISCIPLINE _____ NAME _____

AREA EVALUATED	CONDITION
OUTLET CHANNEL	Natural river bed of Connecticut River.
General Condition of Concrete	
Rust or Staining	
Spalling	
Erosion or Cavitation	Major erosion and cavitation where crib apron sections have failed. Cavitation appears to be undermining remaining portions of dam.
Visible Reinforcing	
Any Seepage or Efflorescence	
Condition at Joints	
Drain Holes	
Channel	
Loose Rock or Trees Overhanging Channel	
Condition of Discharge Channel	

APPENDIX C

PHOTOGRAPHS



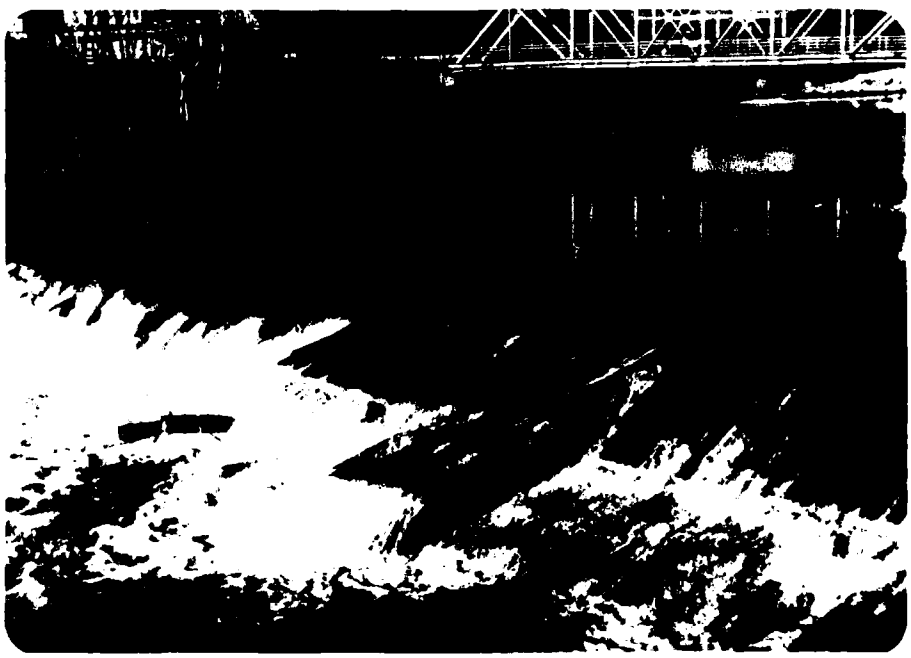
NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

CONNECTICUT GROVETON DAM

PHOTOGRAPH LOCATION PLAN

NEW HAMPSHIRE

#1. VIEW OF SPILLWAY



#2. VIEW OF SPILLWAY

#3. VIEW OF SPILLWAY AND RIGHT POWER HOUSE

#4. VIEW OF LEFT POWER HOUSE

#5. VIEW OF LEFT ABUTMENT WALL SHOWING SPALLING CONCRETE

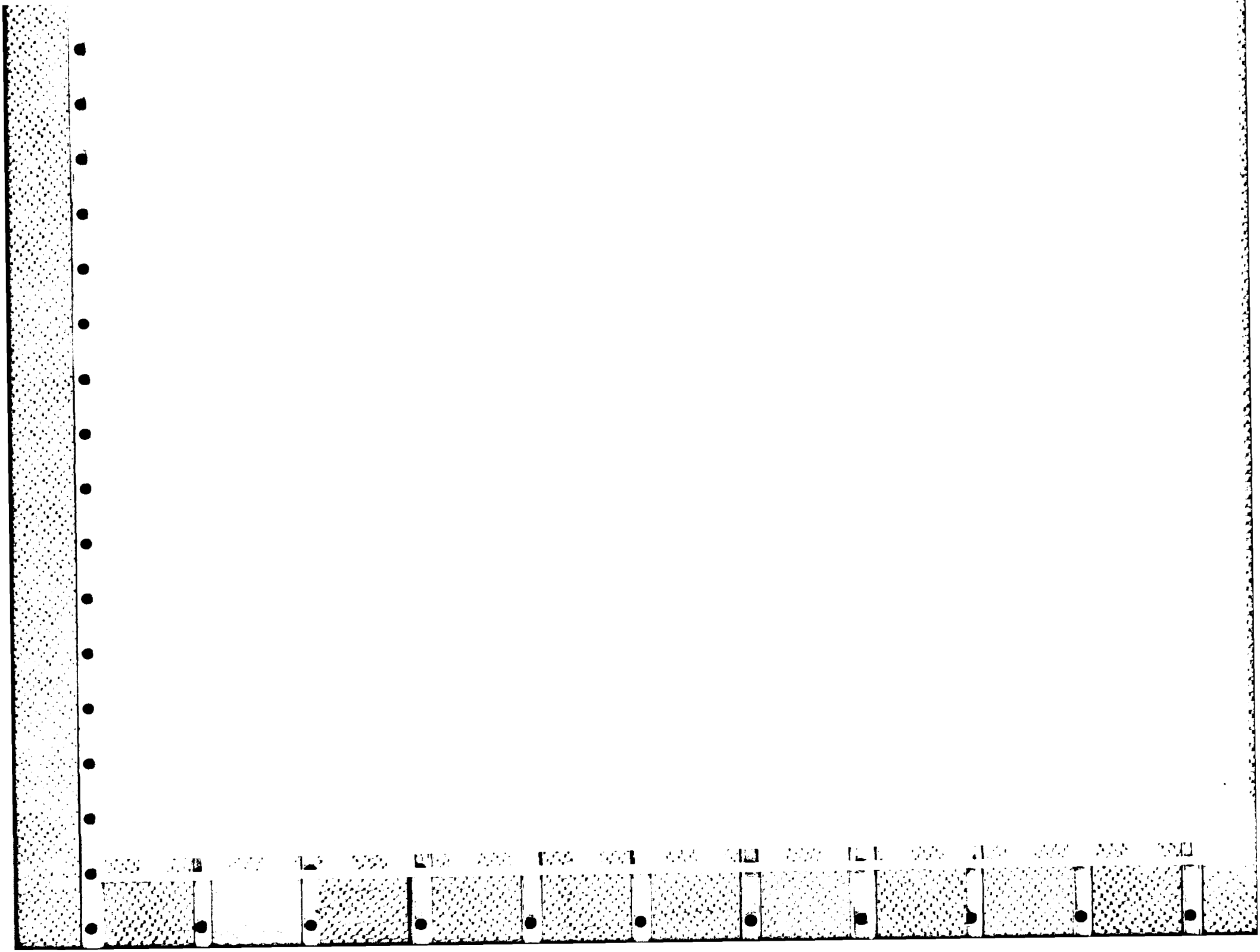
#6. VIEW OF DOWNSTREAM SIDE OF RIGHT POWER HOUSE

#7. VIEW OF BYPASS CHANNEL

#8. VIEW OF BYPASS CHANNEL

#9. VIEW OF BYPASS CHANNEL

#10. VIEW OF UPSTREAM IMPOUNDMENT SHOWING TRAFFIC BRIDGE



APPENDIX D

HYDROLOGIC AND HYDRAULIC COMPUTATIONS

TEST FLOOD CALCULATION (UTILIZING RECORD DATA FROM DALTON GAUGING STATION)

DRAINAGE AREA BETWEEN DALTON AND GROVETON = 320 mi^2

1514 mi^2 (DALTON) − 320 = 1194 mi^2 DRAINAGE AREA TO GROVETON

$1514/1194 = 1.26$

$1.26^{.75} = 1.19$ = HYD. RATIO OF DALTON / GROVETON

100 YR. FLOOD CALCULATED FOR DALTON = 49,400 CFS
(SEE COMPUTER SHEETS)

100 YR. FLOOD AT GROVETON = $49,400/1.19$ = 41,500 CFS

STORAGE ROUTING

DRAINAGE AREA = 1194 mi^2 = 764,160 ACRES

ESTIMATED STORAGE AREA = 235 ACRES

PERCENT STORAGE/DRAINAGE AREA = $235/764,160$ = .0307 %

ACCORDING TO U.S. DEPT OF AGRICULTURE SOIL CONSERVATION SERVICE PRACTICES, STORAGE PERCENTAGES BELOW .2 % WILL NOT RESULT IN ANY SIGNIFICANT FLOW REDUCTION DUE TO STORAGE

STORAGE CAPACITIES

SINCE DAM IS RUN OF THE RIVER TYPE, STORAGE CAPACITIES WERE NOT CALCULATED.

FLOOD FLOW FREQUENCY COMPUTATION

01131500 CONNECTICUT RIVER NEAR DALTON, NEW HAMPSHIRE

N	NQH	NOUTL	IYRA	IPLOT	IEXPP	SKEW	A	B	PRELM
69	0	0	1936	1	1	0.320	0.0	0.0	0.0

DAY	MONTH	YEAR	FLOW	ORDERED	RANK	PLOT POS
0	0	1928	44300.	48300.	1	0.0200
0	0	1929	28200.	44300.	2	0.0400
0	0	1930	17100.	35800.	3	0.0600
0	0	1931	15900.	34600.	4	0.0800
0	0	1932	20200.	34100.	5	0.1000
0	0	1933	35800.	32200.	6	0.1200
0	0	1934	31500.	31500.	7	0.1400
0	0	1935	22500.	31300.	8	0.1600
0	0	1936	48300.	29400.	9	0.1800
0	0	1937	19600.	28600.	10	0.2000
0	0	1938	19600.	28200.	11	0.2200
0	0	1939	23600.	27400.	12	0.2400
0	0	1940	31300.	27100.	13	0.2600
0	0	1941	19300.	26600.	14	0.2800
0	0	1942	23100.	24900.	15	0.3000
0	0	1943	21400.	24000.	16	0.3200
0	0	1944	20400.	23600.	17	0.3400
0	0	1945	24900.	23100.	18	0.3600
0	0	1946	14100.	22800.	19	0.3800
0	0	1947	21800.	22600.	20	0.4000
0	0	1948	16800.	22500.	21	0.4200
0	0	1949	16000.	21800.	22	0.4400
0	0	1950	21300.	21400.	23	0.4600
0	0	1951	18400.	21300.	24	0.4800
0	0	1952	18300.	20800.	25	0.5000
0	0	1953	34600.	20600.	26	0.5200
0	0	1954	34100.	20400.	27	0.5400
0	0	1955	27100.	20400.	28	0.5600
0	0	1956	18000.	20200.	29	0.5800
0	0	1957	13800.	19600.	30	0.6000
0	0	1958	28600.	19600.	31	0.6200
0	0	1959	14700.	19300.	32	0.6400
0	0	1960	27400.	18400.	33	0.6600
0	0	1961	14000.	18300.	34	0.6800
0	0	1962	20400.	18000.	35	0.7000
0	0	1963	20600.	17200.	36	0.7200
0	0	1964	22800.	17100.	37	0.7400
0	0	1965	8370.	16800.	38	0.7600
0	0	1966	14600.	16200.	39	0.7800
0	0	1967	15400.	16000.	40	0.8000
0	0	1968	15300.	15900.	41	0.8200
0	0	1969	29400.	15400.	42	0.8400
0	0	1970	24000.	15300.	43	0.8600
0	0	1971	17200.	14700.	44	0.8800
0	0	1972	32200.	14600.	45	0.9000
0	0	1973	20800.	14100.	46	0.9200
0	0	1974	26600.	14000.	47	0.9400
0	0	1975	16200.	13800.	48	0.9600
0	0	1976	22600.	8370.	49	0.9800

AN	4.3323
D DEV	0.1444
MPUTED SKEW	0.0835
ECNAL SKEW	0.3200
OPTED SKEW	0.2443

MPUTED FLOW	EXPECTED-PROBABILITY FLOW	PROBABILITY	.05 LIMIT	.95 LIMIT
61791.	66492.	0.002	77722.	52225.
54614.	57676.	0.005	67138.	46893.
49421.	51538.	0.010	59662.	42965.
44015.	45800.	0.020	52594.	39101.
39524.	40378.	0.040	45884.	35262.
33163.	33553.	0.100	37456.	30118.
28300.	28466.	0.200	31288.	26010.
21204.	21204.	0.500	22944.	19581.
16144.	16115.	0.800	17629.	14634.
14171.	14043.	0.900	15383.	12581.
12741.	12562.	0.950	14151.	11129.
10531.	10239.	0.990	11942.	8910.

FLOW IN CUBIC FEET PER SECOND

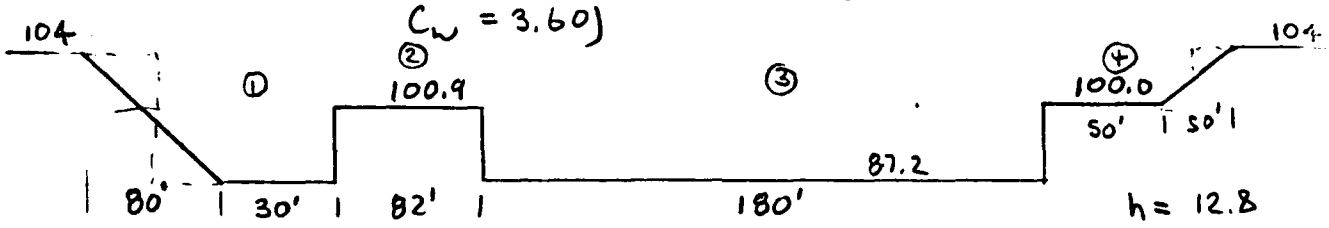
100 year flood = 49400 cfs

25 year flood = 39500 cfs

100 year flood stage = 25.48

25 year flood stage = 23.55

SPILLWAY CAPACITY (EXISTING CREST IS VERY IRREGULAR WITH MOST OF APRON WASHED AWAY ASSUME $C_w = 3.60$)



MAIN SPILLWAY $Q = CLH^{3/2} = (3.6)(180)(45.8) = 29,674$ SAY 29,700 CFS

BY-PASS CHANNEL $Q = CLH^{3/2} = (2.5)(30)(45.8) = 3435$ 3,400 CFS

TOTAL CAPACITY = 33,100 CFS

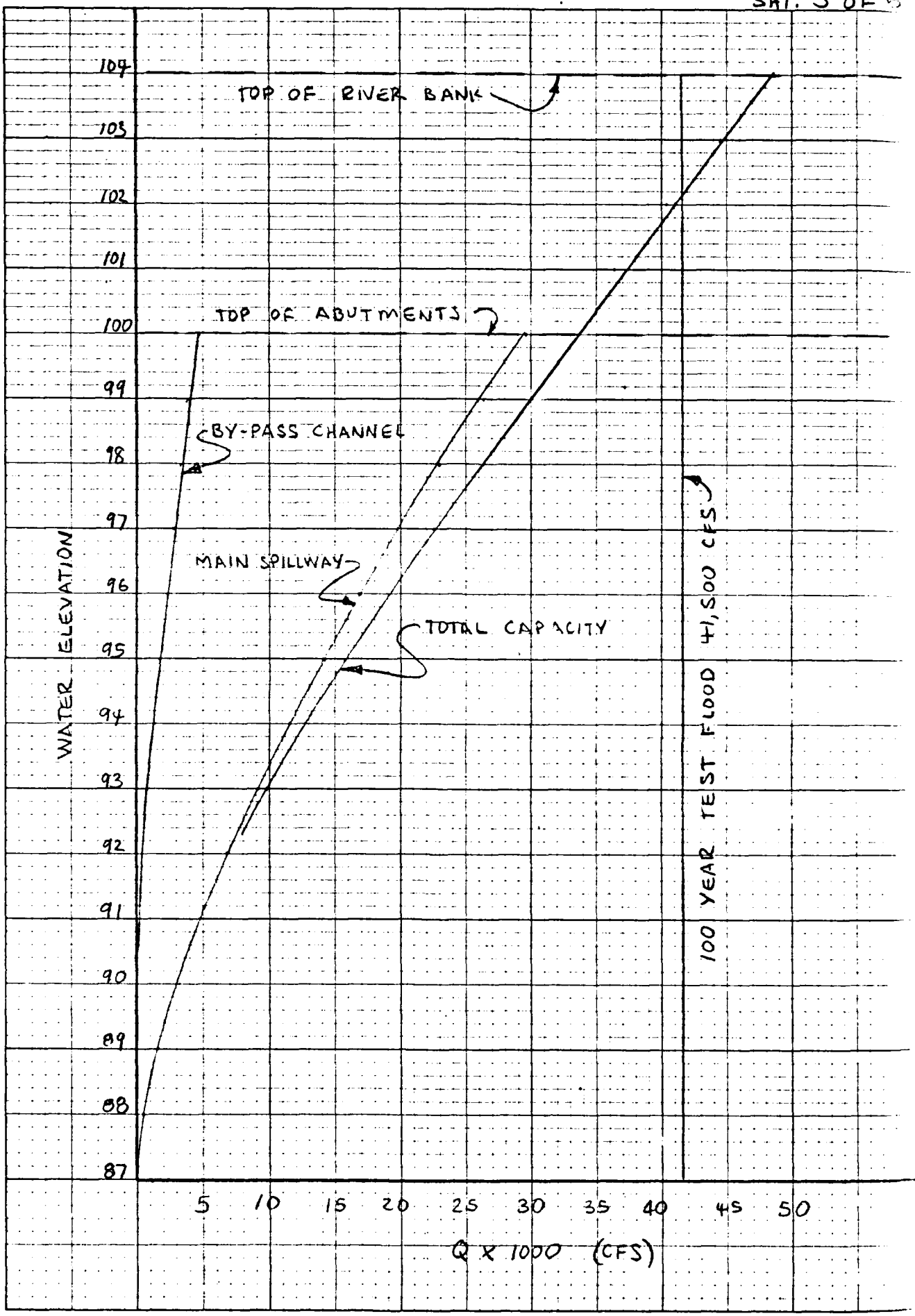
MAX. CAPACITY @ 104 $h = 16.8$

$A = \overset{①}{1176} + \overset{②}{254} + 3024 + 300 = 4754 \text{ FT}^2$

$Q = (2.5)(4754)(4.10) =$ 48,728 CFS

FLOOD STAGE CALCULATION

ELEVATION	MAIN SPILLWAY FLOW		BYPASS CHANNEL FLOW		TOTAL FLOW CFS
	h	Q	h	Q	
88	.8	464	0	0	464
89	1.8	1565	.8	54	1619
90	2.8	3036	1.8	190	3226
91	3.8	4800	2.8	387	5187
92	4.8	6814	3.8	638	7452
93	5.8	9051	4.8	946	9997
94	6.8	11,490	5.8	1309	12799
95	7.8	14,116	6.8	1729	15,845
96	8.8	16,916	7.8	2206	19,122
97	9.8	19,879	8.8	2741	22,620
98	10.8	22,999	9.8	3336	26,335
99	11.8	26,266	10.8	3993	30,256
100	12.8	29,674	11.8	4712	34,386
101					36,141
102					40,238
103					44,500
104					48,728


104
103
102
101
100
99
98
97
96
95
94
93
92
91
90
89
88
87
TOP OF RIVER BANK
TOP OF ABUTMENTS
BY-PASS CHANNEL
MAIN SPILLWAY
TOTAL CAPACITY
100 YEAR TEST FLOOD 41,500 CFS
WATER ELEVATION
5 10 15 20 25 30 35 40 45 50
Q X 1000 (CFS)

DAM FAILURE ANALYSIS

HEIGHT OF DAM = 11 FEET ±, WIDTH = 250'

HIGH FLOW CONDITIONS

DAM IS NEARLY COMPLETELY BACKWATERED DURING HIGH FLOW CONDITIONS. THEREFORE ANY FAILURE WOULD NOT RESULT IN ANY SIGNIFICANT FLOW INCREASE.

LOW FLOW CONDITIONS

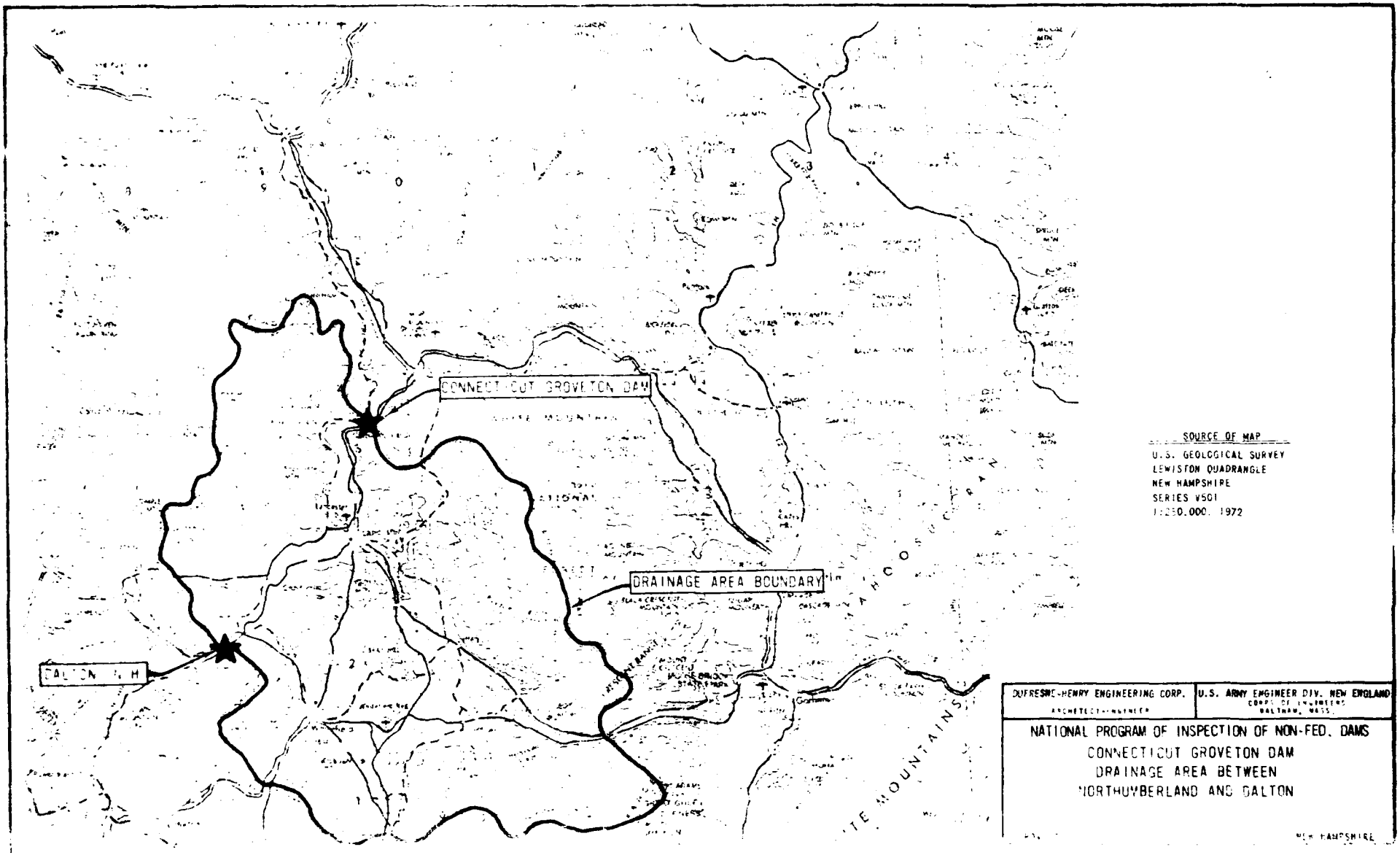
$$Q_{MAX} = \frac{8}{27} W_b \sqrt{g}\, Y_o^{3/2}$$

$W_b = .4\,(250) = 100$
$Y_o = 11$

$$Q_{MAX.} = \frac{8}{27}(100)(\sqrt{32.2})(11)^{3/2}$$

$$= \underline{6134 \text{ CFS}} \quad \text{FLOOD FLOW}$$

TOTAL RIVER CAPACITY IS IN THE RANGE OF 50,000 CFS. DAM FAILURE UNDER LOW OR NORMAL FLOW CONDITIONS WILL BE INSIGNIFICANT.



APPENDIX E

Information as Contained in the National Inventory of Dams

INVENTORY OF DAMS IN THE UNITED STATES

(1) STATE	(2) IDENTITY NUMBER	(3) DIVISION	(4) STATE	(5) COUNTY	(6) CONGR DIST	(7) STATE	(8) COUNTY	(9) CONGR DIST	(9) NAME	(10) LATITUDE (NORTH)	(11) LONGITUDE (WEST)	(12) REPORT DATE DAY | MO | YR
NH	167	NED	33	007	02				CONNECTICUT GROVETON DAM	4435.5	7133.2	01MAR79

(13) POPULAR NAME	(14) NAME OF IMPOUNDMENT
LOWER DAM	CONNECTICUT RIVER

(15) REGION	(16) BASIN	(17) RIVER OR STREAM	(18) NEAREST DOWNSTREAM CITY-TOWN-VILLAGE	(19) DIST FROM DAM (MI.)	(20) POPULATION
01	08	CONNECTICUT RIVER	NORTHUMBERLAND	0	2493

(21) TYPE OF DAM	(22) YEAR COMPLETED	(23) PURPOSES	(24) STRUCTURAL HEIGHT (FT.)	(25) HYDRAULIC HEIGHT (FT.)	(26) IMPOUNDING CAPACITIES MAXIMUM (ACRE-FT.)	(27) NORMAL (ACRE-FT.)	(28) DIST	(29) OWN	(30) FED R	(31) PRV/FED	(32) SCS A	(33) VER/DATE
PGCI	1920	U	26	24	1700	550	FED	N	N	N	N	01MAR79

(34) REMARKS

1=NH18201 21=LOG CRIB,STONE,CONC 22=APPROX 23=UNUSED 26=APPROX 27=APPROX

(35) O/S HAS	(36) SPILLWAY CREST LENGTH	(37) TYPE	(38) WIDTH (FT.)	(39) MAXIMUM DISCHARGE (CFS)	(40) VOLUME OF DAM (CY)	(41) POWER CAPACITY INSTALLED (MW)	(42) PROPOSED (MW)	(43) NAVIGATION LOCKS NO	(44) LENGTH (FT.)	(45) WIDTH (FT.)	(46) LENGTH (FT.)	(47) WIDTH (FT.)	(48) LENGTH (FT.)	(49) WIDTH (FT.)	(50) LENGTH (FT.)	(51) WIDTH (FT.)
S	550	U	180	29700												

(52) OWNER	(53) ENGINEERING BY	(54) CONSTRUCTION BY
GROVETON PAPERS CO		

(55) REGULATORY AGENCY			
(56) DESIGN	(57) CONSTRUCTION	(58) OPERATION	(59) MAINTENANCE
NH WATER RES BD	NH WATER RES BD	NH WATER RES BD	NH WATER RES BD

(60) INSPECTION BY	(61) INSPECTION DATE DAY | MO | YR	(62) AUTHORITY FOR INSPECTION
DUFRESNE HENRY ENG. CORP.	16NOV78	PUBLIC LAW 92-367 6AUG1972

(63) REMARKS

50=DA>1194 51=GATES INOPERATIVE

END

FILMED

8-85

DTIC